

obtain reliable means for each month. The relations, if any exist, between the daily variability of temperature and the mean monthly temperature have not been very thoroughly investigated. For instance, it is possible that in extremely cold months the variability of temperature is greater, and in warm months less, than the average.

Using data compiled by Wahlén from long records of Russian stations, the author has undertaken this investigation. The Russian stations used are Warsaw (101 years), Port Baltic (44 years), Archangel (68 years), Astrakhan (44 years), Katharinenburg (52 years), Barnaul (45 years), and Yakutsk (37 years). In addition, data for Vienna (75 years) and for Pola (40 years) compiled by von Hann, were used.

The results of the investigation were three fold: For Pola, which typifies the climate influenced by the ocean, there was no relation between the variability and the departure from the monthly mean. Vienna, Warsaw, Port Baltic, Archangel, and Astrakhan fall into a second group, in which the following relation seems to hold: In the months colder than normal the variability of daily temperatures is greater than the average; in months warmer than normal, it is less than the average. This region seems to form a transition between oceanic and continental climates. At Barnaul and Katharinenburg in west Siberia, this rule does not hold, and at Yakutsk in east Siberia the relation is reversed; i. e., in winter months colder than normal there is a small variability of temperature, and in those warmer than normal the variability is large.

The proof that these relations are not accidental is to be found in the smooth progression of values from Pola to Yakutsk. The relation is weakest in regions of most intense cold. Great variability of temperature implies cold and warm waves following one another rapidly. But in Yakutsk the lower the monthly mean lies the more uniform the temperature, because of fewer warm waves.<sup>1</sup>—C. L. M.

#### THE LAWS OF APPROACH TO THE GEOSTROPHIC WIND.

By F. J. W. WHIPPLE.

[Abstracted from *Quar. Jour. Roy. Met'l Soc.*, 46, 39-53, Jan., 1920.\*]

In the steady state, the forces at each level in the atmosphere due to rotation, gradient, and internal friction (eddy viscosity) must balance; in the layer next to the surface, the additional drag due to friction is practically equal and opposite to the drag due to the eddies, since it may be shown that the combined effect of pressure and rotation is only one-thirtieth that of one of the other two forces, and hence may be ignored. The actual wind at any level is considered as the vector sum of the gradient wind and a fictitious "relative wind." In the case of straight, parallel, motionless isobars, with uniform distribution of density, gradient, and eddy motion throughout the height considered, the above conditions lead to three laws: I. The relative wind falls off with increase of height according to the exponential law  $R = R_0 e^{-(Bz-z_0)}$ , where  $R$  is the relative wind at the height  $z$ , and  $R_0$  that at height  $z_0$ ;  $B$  is a constant,  $B^2 = \omega \sin \lambda (\rho/\mu)$ . II. The direction of the relative wind turns uniformly with increase of height, the circular measure of its azimuth being given by  $\phi - \phi_0 = B(z - z_0)$ .

<sup>1</sup> The colder the air, the stronger the disturbance necessary to blow it away. But in the coldest weather in continental interiors, such as central Siberia, the winds are usually weak. The warm winds of winter may glide over the cold surface layers for many hours and may not reach the surface at all before they cease to blow.—EDITOR.

\* Cf. *Science Abstracts*, Apr. 30, 1920, p. 518.

III. The angle between the actual wind near the surface and the relative wind there is  $135^\circ$ . The velocity curve traced out by the lines, drawn from a fixed origin, representing the relative winds at all heights, is the equi-angular spiral of Ekman, the constant angle between the radius vector and the tangent (the latter representing transfer of momentum by the eddies) being  $45^\circ$ . The Law of Dynamic Similarity then leads to Taylor's relation,  $V_0 = G(\cos \alpha - \sin \alpha)$ .

The first two laws also hold when  $G$  changes with height:  $G = G_0 + Az$ ; then  $e^{-3\pi/4} R_0 = a(V_0 - U)$ , where  $U = A/aB\sqrt{2}$ , and  $a = K\rho V_0/\mu B\sqrt{2}$ , a generalization of Law III. With  $V_0$  and  $U$  known,  $G_0$  may be computed; and with the law of change of  $G$  with height known,  $V$  at any level may be computed. The theory is applied to the case where observation shows east winds at the surface to be replaced by west winds at 2,000 meters, so that the change of gradient wind with increasing height is equivalent to the addition of a westerly component; then for surface winds of equal strength, it is found that the backing of the surface wind is least for south winds, greatest for north winds; the ratio of surface wind to gradient wind is least for southeast gradient wind and greatest for northwest. This shows the tendency for the surface wind to be governed by the geostrophic wind aloft rather than the geostrophic wind at the surface.

The theory is applied in detail to Dobson's Salisbury Plain observations, and again the fact is theoretically confirmed that the gradient speed is attained at about 300 meters, while the gradient direction is not attained until a much greater height. Comparisons of theory with observation are rendered difficult because of the influence of the anemometer exposures, but such comparisons as have been made, especially with the data of T. Koraen, tend to confirm the theory—south winds being much lighter in comparison with gradient winds than those from northwest.

(Cf. MONTHLY WEATHER REVIEW: July, 1915, 43: 315-316; Sept., 1917, 45: 455; Jan., 1918, 46: 22; May, 1918, 46: 211; Oct., 1919, 47: 703-707.—E. W. W.)

#### TECTONIC EARTHQUAKES AND VARIATIONS OF LATITUDE.

By G. ZEIL.

[Abstracted from *Comptes Rendus*, Paris Academy of Sciences, t. 171, pp. 311-313, Aug. 2, 1920.]

Omori, Milne, and Cancani found that destructive earthquakes took place at or near times of maximum or minimum variation of latitude. Brillouin concluded that variations of latitude were caused by sudden internal movements, of seismic origin; Montessus de Ballore's former doubts about this would not now hold, since he has come to believe that earthquakes and epirogenic movements are one and the same. (*C. R.*, 158, 1833, 1914.)

The present author states that on a parallel of latitude, the various molecules of the lithosphere are in equilibrium two by two, at the opposite extremities of diameters of the circle; if one of these molecules is displaced along the diameter, a seesaw movement of the diameter will take place such that the displaced extremity will be above the normal level of rotation if it approaches the center, and below if it recedes from the center. On the basis of his former studies (see MONTHLY WEATHER REVIEW, 48, 356, June, 1920), Zeil then

contends that in this manner *centrifugal* earthquakes will cause the polar axis to incline toward the readjusted arch and increase the latitude of the disturbed area; while *centripetal* quakes will cause the opposite. *Antagonistic* quakes will have little or no effect. It has been shown that the Japanese quakes are of two types—

those of submarine origin, essentially centripetal, and those of continental origin, essentially centrifugal—and their different methods of action explain why the quakes occur either at maximum or minimum variation of latitude.—E. W. W.

## BIBLIOGRAPHY.

## RECENT ADDITIONS TO THE WEATHER BUREAU LIBRARY.

C. FITZHUGH TALMAN, Professor in Charge of Library.

The following books have been selected from among the titles of books recently received as representing those most likely to be useful to Weather Bureau officials in their meteorological work and studies:

**Alt, Eugen.**

Klimatologie von Süddeutschland. IV. Teil. Luftdruckverteilung über Europa, dargestellt nach Pentadenmitteln. (Periode 1880 bis 1909.) Munich. 1919. 12 p. 16 plates. 33 cm. (Sonderabdruck aus dem Deutschen meteorologischen Jahrbuch für Bayern 1919.)

**Angenheister, G.**

Sonnenstrahlung, Sonnenstrahlung, Lufttemperatur und erdmagnetische Aktivität im Verlauf einer Sonnenrotation. Göttingen. 1920. 7 p. 23 cm. (Aus den Nachrichten von der K. Gesellschaft der Wissenschaften zu Göttingen.)

**Ångström, Anders.**

Den fuktade termometern i frostvarningarnas tjänst. Stockholm. 1920. 1 sheet. 30 cm. (Särtryk ur Landmannen, Tidskrift för landman, nr. 22 1920.)

Väderlekstjänsten till jordbrukets fromma. Stockholm. 1920. 8 p. 23½ cm. (Särtryck ur jordbrukstidskriften Svenskt Land 1920.)

**Atkins, W. R. G.**

Variation of temperature and humidity with altitude; notes on the wind and other meteorological observations made at Aboukir. London. [1919] 10 p. 24 cm. (Great Britain. Advisory committee for aeronautics. Reports and memoranda, no. 436. April, 1918.)

**Cave, C. J. P.**

Thunderstorms in the British Islands during January, February, and March, 1917. London. 1919. 6 p. 24 cm. (Great Britain. Advisory committee for aeronautics. Reports and memoranda, no. 507. June, 1917.)

**Clayton, Brian C., & Shaw, Sir Napier.**

Records of temperature and altitude. London. 1919. 10 p. 24 cm. (Great Britain. Advisory committee for aeronautics. Reports and memoranda, no. 501. May, 1917.)

**Chile. Instituto meteorológico y geofísico.**

Instrucciones meteorológicas. Santiago. 1919. 125 p. 26 cm.

**Chistoni, Ciro.**

Contributo allo studio dell'altezza specifica e della densità delle nevi. Naples. 1919. 7 p. 24 cm. (Estr. dal Rend. della R. Accad. delle scienze fisiche e matematiche di Napoli. Serie 3a, vol. 25, 1919.)

Eliofanometro, eliografano ed eliografia. Naples. 1920. p. 3-8. 24 cm. (Estr. dal Bollettino della Soc. dei naturalisti in Napoli. Vol. 23, 1920.)

Notizie sulla pioggia torrenziale e sulla grandine del giorno 6 di giugno 1918. Naples. 1918. 6 p. 24 cm. (Estr. dal Rend. della R. Accad. delle scienze fisiche e matematiche di Napoli. Serie 3a, vol. 24, 1918.)

**Dietzius, Robert.**

Zur Fälschung der Bahnen von Pilotballonen durch vertikale Luftströmungen. Leipzig. [1914]. p. 57-72. 26½ cm. (Sonderabdruck. Beiträge zur Physik der freien Atmosphäre. Bd. 6; H 2.) [Cites case of evident vertical motion, and attempts to compute the speed of the vertical currents from the erratic character of the horizontal projection based on observations with one theodolite.]

**Dines, W. H.**

Table of temperature, pressure and density at different levels up to 20 kilometers. London. 1919. 1 p. 24 cm. (Great Britain. Advisory committee for aeronautics. Reports and memoranda, no. 509. July, 1917.)

**Dobson, G. B. M.**

Errors of the readings of altimeters and air-speed indicators due to variation of temperature of the air. London. 1919. 6 p. 24 cm. (Great Britain. Advisory committee for aeronautics. Reports and memoranda, no. 610. May, 1919.)

Observations of wind structure made at Upavon in 1914. London. [1919] 42 p. 24 cm. (Great Britain. Advisory committee for aeronautics. Reports and memoranda, no. 325. April, 1917.)

**Elgie, Joseph H.**

Elgie's weather book. London. 1920. 251 p. 16 cm. [Reviewed in *Nature*, Aug. 12, 1920, p. 739.]

**Great Britain. Advisory committee for aeronautics.**

Meteorology. London. [n. d.] 21 p. 24 cm. (Reports and memoranda, no. 296. Aug., 1916.)

**Great Britain. Naval meteorological service.**

Variation of wind speed near the ground. London. 1919. 8 p. 24 cm. (Great Britain. Advisory committee for aeronautics. Reports and memoranda, no. 531. March, 1918.)

**Great Britain. Royal aircraft factory.**

Effect of abnormal weather on aeroplane performance. London. 1919. 4 p. 24 cm. (Great Britain. Advisory committee for aeronautics. Reports and memoranda, no. 281. July, 1916.)

**Great Britain. Royal flying corps.**

Note on the tail method of observing pilot balloons. London. [1919] 6 p. 24 cm. (Great Britain. Advisory committee for aeronautics. Reports and memoranda. (New series) no. 309. Jan., 1917.)

**Haeuser, Josef.**

Kurze starke Regenfälle in Bayern, ihre Ergiebigkeit, Dauer, Intensität, Häufigkeit und Ausdehnung. Nach den Beobachtungen der Jahre 1899-1915 unter besonderer Berücksichtigung ihrer Bedeutung und Verwendbarkeit für die Wasserwirtschaft. Munich. 1919. 242 p. 252 Abbildung. 32 cm. (Abh. der Bay. Landesstelle f. Gewässerkunde.)

**Hildebrandsson, H. H.**

Étude préliminaire sur les vitesses du vent et les températures dans l'air libre a des hauteurs différentes. Upsala. 1920. p. 97-118. 24½ cm. (Geografiska annaler 1920, H. 2.)

**Idrac, P.**

Soaring flight in Guinea. (Translated from the French by D. L. Bacon.) [Manifolded]. [Washington. 1920.] 5 p. 28 cm. (U. S. National advisory committee for aeronautics. Technical notes. No. 13.) [Abstract in later Review.]

**Kienle, Hans.**

Temperaturverteilung in Innern und in der nächsten Umgebung eines freiem Durchzug geöffneten Gebäudes. Munich. 1919. 3 p. 33 cm. (Sonderabdruck aus dem Deutsches meteorol. Jahrbuch für Bayern 1919.)

**McEwen, George F.**

Ocean temperatures, their relation to solar radiation and oceanic circulation. Quantitative comparisons of certain empirical results with those deduced by principles and methods of mathematical physics. Berkeley. 1919. p. 327-421. 27 cm. (Reprint from a volume of Miscellaneous studies in agriculture and biology in the Semicentennial publications of the University of California, 1869-1918.)

**McLaughlin, Walter W.**

Capillary movement of soil moisture. Washington. 1920. 70 p. 23 cm. (U. S. Dept. of agr. Bull. 835.) [Effect of temperature on soil moisture conditions, p. 56.]

**Milligan, L. H., Crites, D. O., & Wilson, W. S.**

Indicators for carbon dioxide and oxygen in air and flue gas. Washington. 1920. 23 p. 23 cm. (U. S. Bureau of mines. Technical paper 238.)

**Naples. R. Università. Istituto fisica terrestre.**

Valori orari diurni delle precipitazioni registrate all'Istituto. (1909-1916 inclusivi.) Naples. 1917. 47 p. 33 cm.

**Norinder, Harald.**

Recherches sur le gradient du potentiel électrique de l'atmosphère a Upsala. Stockholm. 1917. 57 p. 30 cm. (Kungl. Svenska vetenskapsakademiens handlingar. Bd. 58. Nr 4.)